João Pedro Xavier

Exhibit Review

Nel segno di Masaccio. L'invenzione della prospettiva.
(In the Traces of Masaccio. The Invention of Perspective.)

Galleria degli Uffizi, Florence, Italy
16 October 2001 — 7 April 2002

Introduction

The exhibit *Nel Segno di Masaccio* was one of the events commemorating the six hundredth anniversary of Masaccio's birth.[1] Conceived and coordinated by Filippo Camerota, it gave rise to the edition of a catalog *Nel segno di Masaccio. L'invenzione della prospettiva* (Ed. Filippo Camerota, Florence, Giunti Gruppo Editoriale, 2001, 352 pp., €36.15), which, besides the convenient evocation of the exhibited material, contains an ensemble of essays by scholars such as Carlo Pedretti, Margaret Daly Davis and J.V. Field. Presented according to the thematic organization of the exhibition, these are already unquestionable references for those interested in perspective.[2]

There is also the webpage (http://galileo.imss.firenze.it/masaccio/indice.html, in Italian only), still on-line, produced by the Laboratorio Multimediale dell'Istituto and the Museo di Storia della Scienza di Firenze that presents the main lines and purposes of the exhibition in a synthetic and efficient way, and summarizes the themes with some images of the main pieces of each section, although it was mainly conceived as a pre-orientation to the visit.

Besides the intrinsic quality of the exhibition and the value of the presented material, I believe it is most remarkable for the fact that it happened at the Uffizi in Florence, the city that was the stage for the invention of Renaissance perspective by men such as Brunelleschi, Masaccio and Alberti. The consciousness of this singular condition was patent in the organization of the intermediate room dedicated to drawing instruments (IX. *L'occhio e le seste : l'invenzione degli strumenti*). There the object of representation was the actual city observed from perspectographs windows, or displayed, as an inverted image, in a camera obscura. And this image was, of course, a view of Piazza della Signoria and Palazzo Vecchio, through the street defined by the Vasarian galleries, an image quite similar to a well known and significant contemporary perspective drawing by Baldassarre Lanci (Fig. 1). This was impossible to get anywhere else!

But if this room could be considered the highest moment of the exhibition it was also the most frustrating one as one's eagerness to utilize and experiment with all these amazing instruments was systematically forbidden, with no mercy. This situation was, in my opinion, the less positive aspect of the exhibition as it prevented the exploitation, in situ, of its enormous didactic potential.

Fig. 1. Perspective drawing of Palazzo Vecchio and Brunelleschi's cupola for S. Maria del Fiore, by Baldassarre Lanci

Museo Dei Ragazzi, Florence

But in fairness I should recall that since the beginning the organizers had conceived the realization of a laboratory about techniques and instruments for drawing in perspective, which opened in November 2002 and is still on display at the Museo dei Ragazzi in Palazzo Vecchio. Part of their current display is an atelier/laboratory—*Magnifici apparati prospettici: l'arte come illusione*[3]—concerned with the theme of perspective vision in drawing and painting in the Renaissance, recreating a *bottega d'artista* from 1400-1500 where everybody is allowed to experiment with the same kind of perspective machines that were exhibited at the Uffizi.

This event is in fact the third and final step of a cycle of initiatives that are part of an ambitious and innovative project of investigations and communications about the relationship between art and science in the Renaissance that began at the end of May 2001 with the fourth edition of the International Laboratory for the History of Science, dedicated to art, science, and drafting techniques in the Renaissance,[4] organized by the Istituto e Museo di Storia della Scienza in Florence and Vinci, and was followed by this present exhibition, *Nel segno di Masaccio*.

The Uffizi Exhibit

The first step of the exhibit was situated in the street, in the middle of Piazzale degli Uffizi, and consisted of an astonishing anamorphic installation of a skeletal dodecahedron reflected on a spherical mirror, constructed by Stella e Gianni Miglietta (Fig. 2). Nothing could have worked better to draw attention to the event and to the magic and mystery of perspective, evocating simultaneously the use of the mirror at the initial experience of Brunelleschi's first *tavoletta* and Leonardo's drawing, included in Luca Pacioli's *De divina proportione*, of the solid that Plato considered the symbol of the Universe. Once inside, after passing a pyramidal corridor, increasing in apparent depth in the manner of Borromini's Galleria Spada in Rome, the same authors constructed

another anamorphic installation. This time it was a spatial one, even more fantastic, as they had disseminated parts of the solid along the rooms of new Uffizi. Naturally, the dodecahedron could be reconstructed, once again, when viewed from the indicated correct point of observation.[5]

Fig. 2. Skeletal dodecahedron reflected on a spherical mirror, constructed by Stella e Gianni Miglietta, in the Piazzale degli Uffizi, Florence, 2001-2002

With this metaphor of the Universe in their eyes, everyone's curiosity was raised to the perfect level to begin to discover how such *meraviglia* could ever be possible! Soon the visitor realized that the aim of perspective inventors was exactly an attempt to reach the Universe in parallel with an indomitable thirst to capture the infinite, to use Leonardo Benevolo's terminology.[6]

After this appealing introduction, the rooms that followed housed different sections or themes, settled in the space chronologically, with the exception of section IX, containing the perspective instruments, as explained before.[7]

We began at section I (Giotto's heritage) with the rebirth of a special attention to natural phenomena, first of all as an attempt to understand the mechanism of seeing and perception (the so-called *perspectiva naturalis* or *communis*) and then with the application of the laws of optics to measure distances (*perspectiva pratica*), mainly the

inaccessible ones (as the height of buildings or hills, the width of a river, etc.), as the visual rays are materialized as lines. All these procedures are not really original, of course. It is sufficient to remember the calculations of the Earth's diameter or the approximate results for the distance from Earth to the Moon or to the Sun. But that was the time of the rediscovery of Greek knowledge and so there was Euclid's *Optics* and Thales's Theorem of similar triangles as background. The *Optics* of Alhazen was the first responsible for this rebirth and this work had an inevitable influence and repercussion in occidental culture as attested by the treatises that followed by Grosseteste, Witelo, Pecham, or Bacon and considering their own roles in further development of perspective. It should be noted that all these precious manuscripts were there at the exhibit to be seen!

Simultaneously we have with Duccio, Giotto, the Lorenzetti brothers and others, the first successful attempts to conquer in painting all the dimensions of space, although without a rigorous law, redirecting the painter's interest for the natural and humanized contingent world.

The search for a legitimate geometric construction was already present but only the next century would provide the passport to cross the bridge to the mathematical world of *perspectiva artificialis* with the premonitory experiences of Brunelleschi, the sublime work of Masaccio, the definitive theoretic contribution of Alberti and the codification of perspective as a science with Piero della Francesca's *De prospectiva pingendi*. This could be apprehended from exhibit sections II through VI.

Let us point first to section II (*Quello che I dipintore oggi dicono prospettiva*, "that which painters today call perspective", Manetti's well known statement about perspective, the invention of which he credits to Brunelleschi), where we felt disappointed with the simulation of Filippo Brunelleschi's first *tavoletta*. Besides some technical difficulties (the mirror and the point of view had to be fixed) I think this time the organization missed the gift of being in Florence. In fact, why did they not make the experiment in front of the real Baptistery? This is even more bizarre if we remember that Filippo Camerota re-created Brunelleschi's peepshow the year before during the already mentioned fourth edition of the International Laboratory for the History of Science. I believe this could be perfectly accomplished, with evident benefits to visitors, with a well defined schedule and certainly a little larger budget.

The third section, (The Trinity: anatomy of a fresco), displayed a convincing work on Masaccio's Trinity (1426-27). In a way, this was the confirmation of the convergence of perpendicular lines from picture plane to a central vanishing point; at the same time there was uncertainty as to the establishment of the real depth of the virtual chapel (although one of the possibilities was shown) due to some liberties taken by the painter in the definition of the vault.[8] In any case, the crucial role of this painting in the history of artificial perspective is taken for granted as it was, up to that time, the most convincing illusion of the existence of real space behind a picture when seen from a certain point of view, which can be intuitively discovered even if it is difficult (not to say impossible) to determine it exactly. Still in this section the Flemish approach was not

forgotten with the reproduction of Van Eyck's masterpiece, the polyptych of Gand (1432), an oil painting where the sensation of depth is also achieved exploring the optic effects of light and color in the modulation of spatial forms, an alternative to the more scientific way pursued in Italy. Very interesting was the possibility of watching two good videos (which are available, I believe), at the end of the exhibition, about these two contemporary and so important paintings.

In section IV (*Il modo optimo*, "the perfect way", of Alberti, Donatello, Ghiberti), the decisive contribution of Alberti is clearly stated. First of all through the definition of painting as the intersection of a visual pyramid of rays with a plane (this definition would be corroborated later by Leonardo da Vinci), perfectly expressed with the definition of the *velo*, an invention he credits to himself. This *velo* is like a gridded window open to the world and became the perfect instrument to capture the reality through the mechanism of projection and according to its inherent geometric rules, which are the rules of perspective. And for Alberti, it was only with this clear scientific side that painting could be considered as art, an idea that would be sacred for almost four centuries until the advent of impressionism, which is more or less coincident with the emergence of photography.

Some of these rules were revealed in his *De pictura* (1435), as the existence of the *punto centrico* (central vanishing point) to which converge the perpendicular lines to the picture plane and, fact more significant, with the presentation of a way of determining the distance of equidistant parallel lines to the same picture plane. What is interesting and could be extracted from a careful analysis of the exhibit is that this method of correctly determining depth derives from the antecedent and current procedures of practical perspective in the determination of distances by the proportionality of similar triangles. Let us add that this is exactly what Alberti himself resorted to when he made the survey and the corresponding plan of the city of Rome with the aid of a tool called *orizzonte*.

Passing section V (*La dolce prospettiva*), where we really savored the sweetness of perspective observing the amazing drawings of Paolo Uccello or the fabulous wood panels of the *maestri intarsiatori*, we arrived at Piero della Francesca's room (section VI: The science of drawing). In Piero we really find the artist and the mathematician together and this fact is evident in all his work.

Piero's manuscript *De prospectiva pingendi* (1474-75) constituted the first codification of perspective and marks the moment of its glorification as an unquestionable means to achieve a perfect reproduction of reality, and reciprocally a process of its simulation, which means an increased knowledge of the natural world and, more than that, a faith in the possibility to control it. A proof of this was the successful reconstitution of the space and ambience of Piero's *Flagellation of Christ* (c. 1460), a careful 3D model made by Philip Steadman.

Also impressive in this section was the attention devoted to Platonic polyhedra, associated with symbolic significance, which Piero brought into the scientific literature of

the time and that have been utilized even in the cosmological model conceived by Johannes Kepler (1596). Largely due to the magnificent illustrations made by Leonardo in *De divina proportione* (1509) by Luca Pacioli, these solids, as well as the Archimedean ones, became well known and recurrent in art and art theory. It is not possible to forget the glass rhombicuboctahedron suspended in space in the portrait of Fra Luca Pacioli in which the Palazzo Ducale di Urbino is reflected. But many other semiregular solids were the object of interest, especially the famous *mazzochio*, a Florentine feminine adornment, repeatedly represented in perspective since Paolo Uccello's first drawings and paintings.

Section VII is dedicated to simulated architecture. This may appear in painting—as in Sacra Conversazione (c. 1472-74) by Piero della Francesca, or in the panels of Urbino which could be seen as a manifesto of the Renaissance ideal city (and where it is difficult not to think again of Piero), or in *di sotto in su* illusions like the one painted by Mantegna on the ceiling of the Camera degli sposi at the Palazzo Gonzaga in Mantova. It may also appear in architectonic space which is itself affected by perspective—as in the false main chapel of Santa Maria presso San Satiro in Milano by Bramante. Simulated architecture is also manifest in the fertile field of the theatrical scene (also a variation on the theme of the ideal city, at that time)—with the work of Peruzzi, Serlio, Vignola-Danti, Palladio and Scamozzi.

Section VIII, Leonardo "*discepolo della sperientia*", is above all interesting as it points to the original contribution of this great master in the field of less considered aspects of perspective representation like his consideration of other supports for projection, as the cylinder or the sphere, while trying to reach the substance of the image produced in the eye or his concern regarding marginal aberrations and the correspondent interest in anamorphosis. His interest in the production of various instruments for geometrical drawing and mechanic reproduction of nature was also highlighted. Regarding this we should point out the two pairs of compasses for drawing conics, underlining the importance of conics to further development of projective geometry, as the study of plane conic sections and the perspective of the circle are two faces of the same coin. On the other hand Leonardo's window will ever be the most direct way to get an intuitive but correct perspective representation; but his famous drawing from Codice Atlantico, f. 5r-a, *Pittore che usa il vetro per disegnare una sfera armilare* (painter using glass to draw an armillary sphere), went further as it showed a procedure to obtain the third cartographic method from Ptolemy's *Geografia* expressly relating perspective with cartography.

The interest in the production of mechanical artifacts in order to reproduce the natural environment with exactitude, stimulated by Leonardo's experiments, became in fact a central theme from the sixteen century on, and that is what we could appreciate in section IX (*L'occhio e le seste: l'invenzione degli strumenti*), strategically placed in the exhibit space, as we have seen. Here, together with section X (*l'Imago Mundi*), the bridge between perspective and cartography become clearer as their alliance in this crusade to represent space scientifically was sealed.

The production of instruments was intensified after the definitive codification by Vignola (written in 1545 but only published in 1583, with Iganazio Danti's commentaries) of what he called the two perspective rules in *Le due regole della prospettiva pratica* (these two rules are the so-called *costruzione legittima*, supported by a double orthogonal projection, and the *costruzione con il punto della distanza* which operates more directly with the same basic properties of central projection). Significantly, Ludovico Cigoli called these instruments *la terza regola*. Since then artists' preference for this third rule also became clearer, as it was directly related to their own practice, while perspective proceeded from then on in the hand of geometers, into the field of pure mathematics, giving rise, with the work of Desargues, to projective geometry where vanishing points and lines in the projective plane became the image of points and lines situated at the infinite.

But the evolution of the instruments also illustrates the development of topographical techniques for surveying and the progressive definition of the science of representing the Earth, due to the development of perspective cartographic projections. And, as soon as the eye's range could be amplified with the aid of telescopes—Galileo considered the telescope as an invention based on the most recondite speculations on perspective—even more sophisticated instruments allowed the first attempts at the rigorous representation of the Heavens.

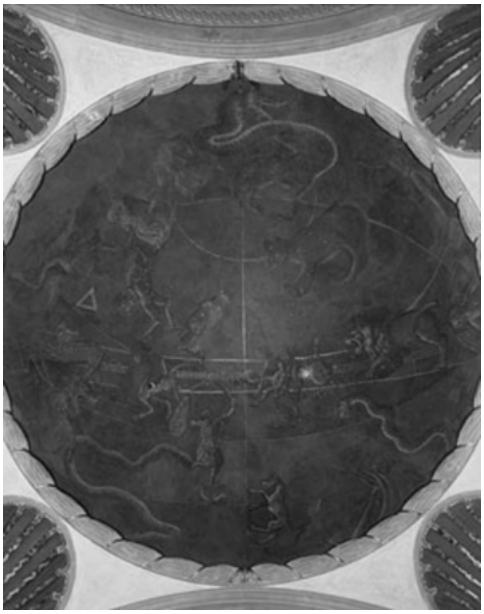

Fig. 3. Il Pesello, representation of the boreal hemisphere in the dome of the presbytery of Sacrestia Vecchia di San Lorenzo, Florence

I conclude by suggesting a visit to that *bottega d'artista* now presented at Museo dei Ragazzi, in Palazzo Vecchio, to play with some of these instruments! Don't be surprised if somehow, manipulating one of these, you might catch a slice of the Universe as il Pesello did when he attempted a representation of the boreal hemisphere in the dome of the presbytery of Sacrestia Vecchia di San Lorenzo by Filippo Brunelleschi (Fig. 3), which was reproduced in full scale at this unforgettable exhibition.

Notes

1. Paolo Galluzzi with Filippo Camerota were the exhibition scientific coordinators and its scientific board included Cristina Acidini, Luciano Berti, Filippo Camerota, Marisa Dalai E miliani, Paolo Galluzzi, Francesco Gurrieri, Martin Kemp, Antonio Paolucci, and Carlo Pedretti.
2. All the information about the catalog, as well as its summary, can be found at http://galileo.imss.firenze.it/masaccio/icatalo.html.
3. See webpage: http://www.museoragazzi.it/museoragazzi/db36cedt.nsf/pages/fr_palazzo?opendocument.
4. The corresponding webpage is: http://www.imss.fi.it/news/elabor1.html.
5. The link http://galileo.imss.firenze.it/masaccio/ianamor/indice.html shows this anamorphic installation.
6. Leonardo Benevolo. *La cattura dell'infinito*. Rome: Laterza, 1991.
7. Please refer to the plan of the exhibition at http://galileo.imss.firenze.it/masaccio/iespo.html and note that while passing the mouse over the spaces the identification of each section will appear.
8. See the article "La costruzione prospettica della *Trinità*" by J.V. Field in the exhibition catalog.

About the Reporter

João Pedro Xavier received his degree in Architecture from the Faculty of Architecture of the University of Porto (FAUP) and is licensed as an architect at the College of Architects in Porto since 1986. He worked in Álvaro Siza's office from 1986 to 1999; at the same time he set up his own practice. He has taught geometry since 1985 at the Architecture School of Cooperativa Árvore in Porto, the Fine Arts School of Porto and since 1991 at the FAUP. In 1996 he wrote *Perspectiva, perspectiva acelerada e contraperspectiva*, published by FAUP Publicações at 1997, and became assistant lecturer of that Chair. He is now preparing his Ph.D. on the same subject. Xavier has always been interested in the relationship between architecture and mathematics, especially geometry. He has published several works and papers on the subject, has presented at conferences, has lectured, and has taught courses to high school teachers. He also collaborated with the Ministry of Education coordinating the team in charge of the elaboration of Descriptive Geometry curricula in Portugal.